



**SLOVENSKI STANDARD**  
**SIST EN 15827:2011**

**01-oktober-2011**

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**Železniške naprave - Zahteve za podstavne vozičke in tekalne sestave**

Railway applications - Requirements for bogies and running gear

Bahnanwendungen - Drehgestelle und Fahrwerke

Applications ferroviaires - Bogies et organes de roulement

**Ta slovenski standard je istoveten z: EN 15827:2011**

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## Railway applications - Requirements for bogies and running gears

Applications ferroviaires - Exigences pour bogies et organes de roulement

Bahnanwendungen - Anforderungen für Drehgestelle und Fahrwerke

This European Standard was approved by CEN on 26 February 2011.

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## Foreword

This document (EN 15827:2011) has been prepared by Technical Committee CEN/TC 256 "Railway applications", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2011, and conflicting national standards shall be withdrawn at the latest by September 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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## Introduction

The objective of this European Standard is to bring all the separate requirements related to the design and validation of bogies and running gear into one document. Since bogies and running gear are frequently produced by a different organisation to that responsible for the overall rail vehicle it starts by identifying the essential information needed to produce the required design.

The performance requirements for bogies and running gear fall into two related areas, covering functionality and safety, as required by TSI Essential requirements. Functionality relates to such things as speed, load capacity, ride quality and operating life. Safety covers gauging, structural integrity, dynamic performance, resistance to derailment and maintenance, etc.

Taking the requirements as a whole they involve three particular areas of expertise and discipline. Since each of these areas form a different part of the engineering process they have been addressed individually in the following main clauses of this standard, namely:

- structural requirements; Clause 6;
- dynamic requirements; Clause 7;
- maintenance requirements; Clause 11.

These clauses provide details of how the overall objectives are to be achieved in these important specific areas. This document structure is typical of the engineering process for the design, validation and maintenance support of bogies.

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A bogie or running gear designed and validated in accordance with this standard will satisfy the Essential Requirements of the rolling stock TSIs.

**EN 15827:2011 (E)****1 Scope**

This European Standard consolidates all the separate requirements specified in rolling stock TSIs and European Standards relating to bogies and running gear together into an overall requirement and process that ensures a functional and safe design is achieved for a defined operating envelope.

There are many European Standards that specify the design requirements and associated processes of bogie and running gear components and sub-assemblies. There are also European standards that specify vehicle performance and validation requirements that depend directly on the bogies or running gear. The objective of this standard is to bring all these separate design criteria together. This is accomplished by specifying the design and validation processes to be used for bogies and running gear with particular focus on the two key disciplines of dynamic behaviour and structural integrity. To ensure that safe operation can be continued throughout the product life the definition of a maintenance plan is also required.

This European Standard is applicable to bogies and running gear intended for vehicles that will operate under the Interoperability Directives on designated TEN routes. The requirements, however, can be used in other applications at the discretion of the interested parties. It specifies the requirements to achieve a satisfactory design of bogie or running gear and to validate the design against the relevant performance and safety criteria. Technical requirements are specified directly or by making reference to the relevant European standards and include the nature and content of an auditable record that should be produced of the design and validation processes.

The requirements address only the design and validation of bogies and running gear. No requirements are set for other systems components that are attached to the bogies or running gear, except to establish that a satisfactory interface has been provided.

NOTE Specifications that relate to bogies and running gear can only be considered in the context of a specific vehicle application. Therefore the performance, both safety and otherwise, can relate only to the bogies and running gear as part of a vehicle configuration and not to the individual elements of the bogies or running gear.

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**2 Normative references**

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- EN 473, *Non-destructive testing — Qualification and certification of NDT personnel — General principles*
- EN 12080, *Railway applications — Axleboxes — Rolling bearings*
- EN 12081, *Railway applications — Axleboxes — Lubricating greases*
- EN 12082, *Railway applications — Axleboxes — Performance testing*
- EN 12299, *Railway applications — Ride comfort for passengers — Measurement and evaluation*
- EN 12663-1, *Railway applications — Structural requirements of railway vehicle bodies — Part 1: Locomotives and passenger rolling stock (and alternative methods for freight wagons)*
- EN 12663-2, *Railway applications — Structural requirements of railway vehicle bodies — Part 2: Freight wagons*
- EN 13103, *Railway applications — Wheelsets and bogies — Powered axles — Design method*
- EN 13104, *Railway applications — Wheelsets and bogies — Non-powered axles — Design method*
- EN 13260, *Railway applications — Wheelsets and bogies — Wheelsets — Products requirements*



- EN 13261, *Railway applications — Wheelsets and bogies — Axles — Product requirements*
- EN 13262, *Railway applications — Wheelsets and bogies — Wheels — Product requirement*
- EN 13298, *Railway applications — Suspension components — Helical suspension springs, steel*
- EN 13597, *Railway applications — Rubber suspension components — Rubber diaphragms for pneumatic suspension springs*
- EN 13715, *Railway applications — Wheelsets and bogies — Wheels — Wheels tread*
- EN 13749:2005, *Railway applications — Wheelsets and bogies — Methods of specifying structural requirements of bogie frames*
- EN 13802, *Railway applications — Suspension components — Hydraulic dampers*
- EN 13913, *Railway applications — Rubber suspension components — Elastomer-based mechanical parts*
- EN 13979-1, *Railway applications — Wheelsets and bogies — Monobloc wheels — Technical approval procedure — Part 1: Forged and rolled wheels*
- EN 14200, *Railway applications — Suspension components — Parabolic springs, steel*
- EN 14363, *Railway applications — Testing for the acceptance of running characteristics of railway vehicles — Testing of running behaviour and stationary tests*
- EN 14535-1, *Railway applications — Brake discs for railway rolling stock — Part 1: Brake discs pressed or shrunk onto the axle or drive shaft, dimensions and quality requirements*
- prEN 14535-2, *Railway applications — Brake discs for railway rolling stock — Part 2: Brake discs mounted onto the wheel — Dimensions and quality requirements*
- EN 14817, *Railway applications — Suspension components — Air spring control elements*
- EN 15049, *Railway Applications — Suspension components — Torsion bar, steel*
- EN 15085-1, *Railway applications — Welding of railway vehicles and components — Part 1: General*
- EN 15085-2, *Railway applications — Welding of railway vehicles and components — Part 2: Quality requirements and certification of welding manufacturer*
- EN 15085-3, *Railway applications — Welding of railway vehicles and components — Part 3: Design requirements*
- EN 15085-4, *Railway applications — Welding of railway vehicles and components — Part 4: Production requirements*
- EN 15085-5, *Railway applications — Welding of railway vehicles and components — Part 5: Inspection, testing and documentation*
- EN 15227, *Railway applications — Crashworthiness requirements for railway vehicle bodies*
- EN 15273-1, *Railway applications — Gauges — Part 1: General — Common rules for infrastructure and rolling stock*
- EN 15273-2, *Railway applications — Gauges — Part 2: Rolling stock gauge*
- EN 15313, *Railway applications — In-service wheelset operation requirements — In-service and off-vehicle wheelset maintenance*

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EN 15437-1, *Railway applications — Axlebox condition monitoring — Interface and design requirements — Part 1: Track side equipment and rolling stock axlebox*

prEN 15437-2, *Railway applications — Axlebox condition monitoring — Performance requirements — Part 2: Onboard systems*

EN 15528, *Railway applications — Line categories for managing the interface between load limits of vehicles and infrastructure*

EN 15663, *Railway applications — Definition of vehicle reference masses*

EN 15686, *Railway applications — Testing for the acceptance of running characteristics of railway vehicles with cant deficiency compensation system and/or vehicles intended to operate with higher cant deficiency than stated in EN 14363:2005, Annex G*

EN 15687, *Railway applications — Testing for the acceptance of running characteristics of freight vehicles with static axle loads higher than 225 kN and up to 250 kN*

prEN 15839, *Railway applications — Testing for the acceptance of running characteristics of railway vehicles — Freight wagons — Testing of running safety under longitudinal compressive forces*

prEN 15892, *Railway applications — Noise emission — Measurement of noise inside driver's cabs*

EN 50125-1, *Railway applications — Environmental conditions for equipment Part 1: Equipment on board rolling stock*

EN 60721-3-5, *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities — Section 5: Ground vehicle installations (IEC 60721-3-5:1997)*

EN ISO 3095, *Railway applications — Acoustics — Measurement of noise emitted by railbound vehicles (ISO 3095:2005)*

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EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2009)*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13749:2005 and the following apply.

#### 3.1 analysis

assessment of performance by calculation, comparison or simulation that does not require the presence of an actual product (though it may use the results of physical measurements or testing)

#### 3.2 bounce

vertical translational motion, perpendicular to the axis of the running rail, where the two ends of the vehicle, bogie or component part move in phase with the same amplitude

#### 3.3 broadly acceptable risk

level of risk that society considers trivial and is consistent with that experienced in normal daily life and any effort to reduce the risk further would be disproportionate to the potential benefits achieved

#### 3.4 coupling element

component that transfers force and provides relative motion between other components but, though not necessarily intended as its primary function to act as a suspension element, can have characteristics that affect the dynamic motion (e.g. bush for damper/link)

**3.5****exceptional load case**

extreme load case representing the maximum load at which full serviceability is to be maintained and used for assessment against static strength (see 6.3.2)

**3.6****fatigue load case**

repetitive load case used for assessment against fatigue strength (see 6.3.4)

**3.7****fatigue strength**

resistance against failure resulting from cyclic loading

**3.8****immediate risk**

condition that results in a hazardous situation before there is an opportunity to detect it and take mitigating action

**3.9****laboratory testing**

performing of tests within a building or restricted area where there is the capability of applying the required inputs and with the equipment capable of monitoring and recording the response

**3.10****lateral motion**

horizontal translational motion, perpendicular to the axis of the running rail, where the two ends of the vehicle, bogie or component part move in phase with the same amplitude

**3.11****load case**

set of loads or combinations of loads that represents a loading condition to which a structure or component is subjected

**3.12****load spectrum/load collective**

defines the numbers of cycles for one or more levels of a repetitive load

**3.13****permanent deformation**

residual plastic deformation of ductile material, that is not recoverable when the applied load is removed

**3.14****pitch**

rotational motion about a lateral axis

**3.15****proven operating envelope**

envelope of safe operation determined by the product validation process expressed in terms of the relevant parameters

**3.16****regulations**

requirements stipulated by legislation or rules and conditions mandated by legislation or prescribed by an infrastructure controller or relevant industry body, or similar

**3.17****roll**

rotational motion about a longitudinal axis, parallel to the axis of the running rail

**EN 15827:2011 (E)****3.18****safety critical component**

component, the single point failure of which creates a serious hazard (as identified by the vehicle risk assessment) before there is an opportunity for the risk to be detected and mitigating action taken

**3.19****safety factor**

factor applied during the strength assessment which makes an allowance for a combination of the uncertainties and the safety criticality

**3.20****significant permanent deformation**

permanent deformation of an amount that infringes on the functionality of the structure by exceeding the component geometric tolerances

**3.21****simulation**

numerical method that uses a set of parameters and rules to describe a system (product or component) in a manner that enables a representative response to be determined from a given set of inputs

**3.22****structural component**

any component or constituent part of a structure that transfers or transmits load from one part of the structure to another

**3.23****suspension element**

bogie component that is designed to change in geometry when subject to load and in so doing control the motion of one part of the vehicle relative to the other (e.g. spring, damper)

**3.24****sway**

combination of lateral and roll motion

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NOTE Sway often results when lateral forces are induced at the centre of gravity of a vehicle body (due to its inertia) and the suspension/support elements are below or above it.

**3.25****testing**

subjecting a sample (or samples) of a product to a selection of specified inputs and measuring and recording its responses

**3.26****track testing**

performing of tests under expected service conditions, on railway infrastructure that represents the actual operating environment, and monitoring and recording the responses

NOTE This is different to on-track testing as required by EN 14363, which requires the test track to have specific characteristics of track layout and the test to cover the planned speed range and cant deficiency applicable to the vehicle.

**3.27****type testing**

subjecting a sample (or samples) of an identified product type to a selection of specified inputs and measuring and recording its responses

**3.28****utilisation**

in structural analysis, the extent to which a component is subject to stress relative to the permissible value when taking into account an appropriate safety factor (see 6.2.2)

**3.29****validation**

process of demonstrating by analysis and/or test that the system under consideration meets in all respects the specification, including requirements due to regulations, for that system

NOTE When applied to a numerical model, validation is the process of demonstrating that the model of the system responds in the manner of the actual system to a sufficient level of accuracy for its purpose.

**3.30****verification**

process of demonstrating by comparison or testing that an analytical result or estimated value is of an acceptable level of accuracy

**3.31****yaw**

rotational motion about a vertical axis

**4 Technical specification and interface management****4.1 General bogie requirements**

The supply of bogies/running gear shall be based on a comprehensive specification. This specification shall consist of all the information describing the functional requirements and the interfaces with associated components and assemblies as indicated below. It shall also comprise the conditions associated with maintenance and any other particular requirements relevant to the application.

The design and validation process requires the integration of different disciplines and areas of expertise and the knowledge associated with them. Therefore, the specification shall include information defining the intended operating conditions of the bogie or running gear. This shall include at least the following:

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- vehicle space envelope;
  - bogie space envelope;
  - physical connections;
  - vehicle body mass, payload and load inputs;
  - operating speed and cant deficiency limit;
  - vehicle body stiffnesses and/or natural frequencies;
  - traction system interfaces and performance;
  - brake system interfaces and performance;
  - hot axlebox detection (HABD);
  - other auxiliary systems (e.g. track/train communications);
  - vehicle gauge;
  - track characteristics;
  - static axle load, dynamic wheel load limits;
  - operating environment (including environmental conditions);

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- duty cycles;
- noise and vibration regulations.

This European Standard applies to the bogies or running gear but they are part of the vehicle as a dynamic system. Therefore, the basic dynamic properties of the vehicle body shall be provided.

The bogie and running gear requirements shall be determined taking into account the overall vehicle characteristics (e.g. the vehicle mass states as specified in EN 15663 and the body structure as specified in EN 12663), the overall dynamic behaviour requirements (e.g. as specified in EN 14363), gauging requirements as required by EN 15273-1 and EN 15273-2 or an alternative standard relevant to the infrastructure and hot axlebox detection as required by EN 15437-1.

There are no general requirements for static axle load, dynamic wheel loads and track loading. The specification shall indicate the infrastructure requirements that apply.

The operating environmental conditions shall be specified in terms of the parameters listed in EN 50125-1 covering, altitude, temperature, humidity, rain, snow and hail, ice, solar radiation and resistance to pollution, plus sea spray according to EN 60721-3-5, Class 5C2. Freight wagons shall comply with altitude class AX with the range set at 2000 m.

The fire standards applicable to the vehicle shall be identified.

The design of bogies and running gear shall take into account any movement constraints imposed by mounted systems (track brakes, antenna, etc.). Requirements shall be stated in the specification.

If the bogie design is to incorporate active components then relevant electrical and pneumatic system interfaces and applicable standards shall be identified. Any electrical bonding requirements shall also be defined.

Some applications may require failure detection systems to be fitted to the bogie or its components. The specification of these systems is outside the scope of this standard except that they shall be treated as any other piece of mounted equipment.

Further guidance on the general content of the specification and the identification of interfaces is given in Annex A.

**NOTE** If the initial specification does not include all of the necessary information then the missing information should be agreed between the customer, supplier and any other involved parties. It should be recognised that the design is an iterative process and if it is necessary to revise parameters to achieve the desired performance, any changes shall be agreed between the involved parties.

## 4.2 Specification of structural information

The aspects of the specification that apply to the structural design, and for which specific data shall be provided, are those that affect the geometry and loading, namely:

- bogie/running gear space envelope;
- bogie/running gear physical connections;
- bogie/running gear component masses and attachments, etc.;
- payload and load inputs, including load/unload cycles;
- traction system components, traction characteristic and duty cycle, operating states including fault conditions (e.g. short circuit torque);
- brake system components, brake system characteristics and duty cycle.

Where the loads are dependent on the vehicle masses these shall be expressed as a function of the reference masses given in EN 15663 or to the specific requirements given in the normative references. However, greater details of specific elements than are defined in EN 15663 are required for the purposes of this European Standard.

The masses and inertias of significant components mounted on the bogie and that are not in the bogie designer's control shall be defined. When equipment is resiliently mounted, and the resulting dynamic response can affect the integrity of the system to a significant degree, then the effective characteristics of dynamic parameters (mass, inertias, stiffnesses, damping) shall also be included.

### 4.3 Specification of dynamics information

The specification shall include those aspects that are particularly relevant to the design and assessment of dynamic behaviour, namely:

- bogie mechanical connections with the vehicle body;
- masses and inertias (e.g. vehicle body parameters) included in the specification;
- other relevant vehicle body characteristics (e.g. stiffness/bending modes) influencing dynamics;
- gauge reference profile (i.e. the vehicle permissible movement envelope);
- bogie movement envelope;
- operating conditions and track characteristics;
- wheel profiles (new to worn) and/or conicity limits if specified.

To correctly design the bogies/running gear the operating condition of the train shall be specified. This shall include at least:

- maximum speed;
- minimum radius curve (including reverse curve);
- maximum cant;
- maximum cant deficiency;

and the following track characteristics:

- track gauge (including any variation due to track widening in small curves);
- rail head profile (new and typical worn);
- inclination of the rail;
- track twist;
- track quality (track geometry deviation relative to line speed).

The track parameters, including the track quality, shall be representative of the intended service routes.

NOTE 1 The way these data are presented will differ, depending on custom and practise of the railway undertaking, the infrastructure manager and the methods employed by the bogie supplier. The Annex of EN 14363 covering "Actual geometry of test tracks" is one form of presentation but may not include all the required data. EN 13803-1 and EN 13803-2 provide data on cant, alignment and minimum curve radii, etc. and will be applicable to new TENS infrastructure.